Space Weather Technical Forecast

Issued on Friday, 17 November 2023 at 01:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained Low over the past 24 hours, with only isolated C-class flares, the largest of which was a C4 peaking at 16/2022 from a region which is currently emerging onto the southeast limb. There are two other sunspot regions on the visible disc, with AR3486 the most notable, a Dai/beta. The other region, AR3487 is a small and weak region. Both are in the western hemisphere, and have been stable.
There were a number of Coronal Mass Ejections (CMEs) visible on coronagraph imagery during the past 24 hours, and analysing them has been complicated. Of all these events, the one with the greatest Earth directed potential was a filament eruption near N15W15 around 16/0100UTC. This feature has been analysed and carries a chance of affecting Earth around the turn of the UTC day Monday 20 into Tuesday 21 November. However, confidence is low regarding this CME arrival.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE and DSCOVR at L1, have been at predominantly Slightly Elevated levels, peaking at 469 km/s at 16/0540 UTC. It is possible that a very weak connection to CH70/- has occurred, as the Phi angle did become negative (towards the Sun) between approximately 16/1700-2100 UTC. However, the rest of the time the Phi angle was mainly positive (away from the Sun), and so any connection to CH70 was weak and temporary. The solar wind density trend was unremarkable - complicated by the switch in measuring satellites but generally staying below average throughout. The IMF was weak, at or below 6nT, while the north-south component ranged between -6 and +5nT. The resulting geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at Background levels. GOES16 high energy (greater than 2MeV) electron flux started at predominantly at Background levels, but did increase through the second half of the day to reach Moderate levels, with a peak of 277 pfu at 16/2025 UTC. The associated 24-hour fluence showed an increasing trend, but despite this remained below the Active threshold (1e8 integrated pfu) threshold. The fluence observation at 17/0001UTC was 7.19e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low, but with a daily Slight Chance of isolated M-class flares due to the new region that is currently rotating onto the southeast limb, plus other regions that are expected to rotate onto the visible disc through the forecast period.

Solar Wind / Geomagnetic Activity: The CME associated with the 16/0100UTC filament eruption may reach Earth, but confidence is low regarding this. Any arrival is unlikely to produce a significant geomagnetic response as the CME is slow and weak.

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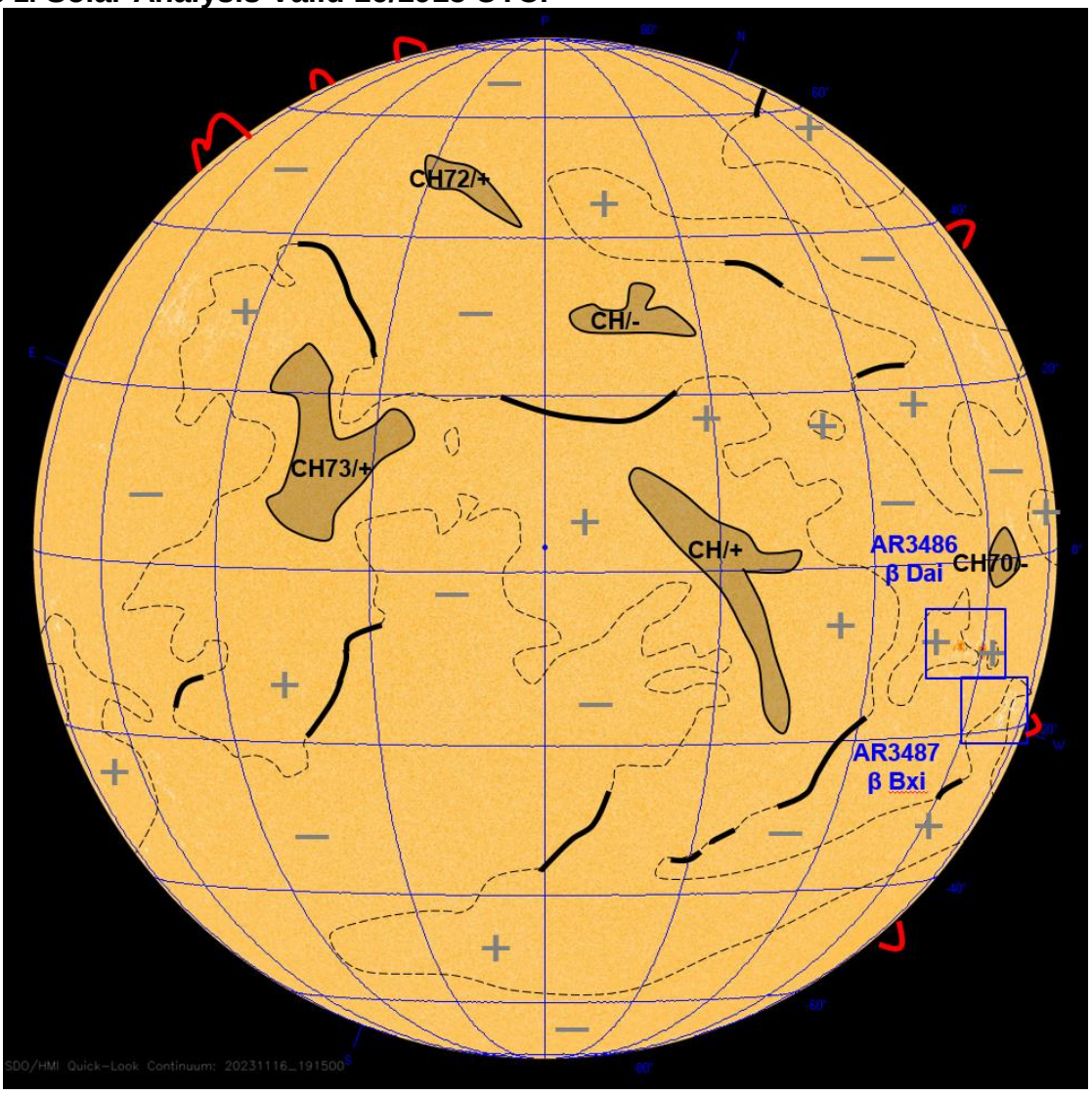
The solar wind is expected to remain at predominantly background levels today and much of tomorrow, although slightly elevated periods are likely to occasionally occur today due to the possible residual influence of CH70. Slightly elevated wind speeds may also occur from late tomorrow (18th) due to further coronal hole influence, from a new feature which has developed near centre disc over the past 24 hours. The influence of this thin coronal hole is likely to wane later in the period.

Geomagnetic activity is expected to remain predominantly Quiet (Kp 0-2), but with isolated Unsettled (Kp 3) intervals possible throughout, especially late tomorrow (18th) into day 3 (19th).

Energetic Particles / Solar Radiation: GOES16 High energy proton flux is expected to remain at Background. GOES16 High energy electron flux is likely to remain at background to moderate levels today and tomorrow, increasing Moderate to possibly High levels from day 3 (19th) due to coronal hole influence. The associated electron fluence is expected to remain below the Active threshold (1e8 integrated pfu), despite a gradually increasing trend.

Figure 1. Solar Analysis Valid 16/1915 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The CME associated with the 16/0100UTC filament eruption may reach Earth, but confidence is low regarding this. Further analysis of the CME has been undertaken, with the modelled results of the re-analysis now awaited. However, any arrival is unlikely to produce a significant geomagnetic response as the CME is slow and weak.

The solar wind is expected to remain at predominantly background levels today and much of tomorrow, although slightly elevated periods are likely to occasionally occur today due to the possible residual influence of CH70. Slightly elevated wind speeds may also occur from late tomorrow (18th) due to further coronal hole influence. This is from a new feature which has developed near centre disc over the past 24 hours, opening up after the filament eruption around 16/0100 UTC. The influence of this narrow coronal hole is likely to wane later in the period. Geomagnetic activity is expected to remain predominantly Quiet (Kp 0-2), but with isolated Unsettled (Kp 3) intervals possible throughout, especially late tomorrow (18th) into day 3 (19th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
16/1608	Partial	Filament	NW	279 km/s	Late 20th into the 21st	Low confidence in arrival. Any impact will be limited.

Figure 2: Latest MOSWOC Enlil ensemble forecast.

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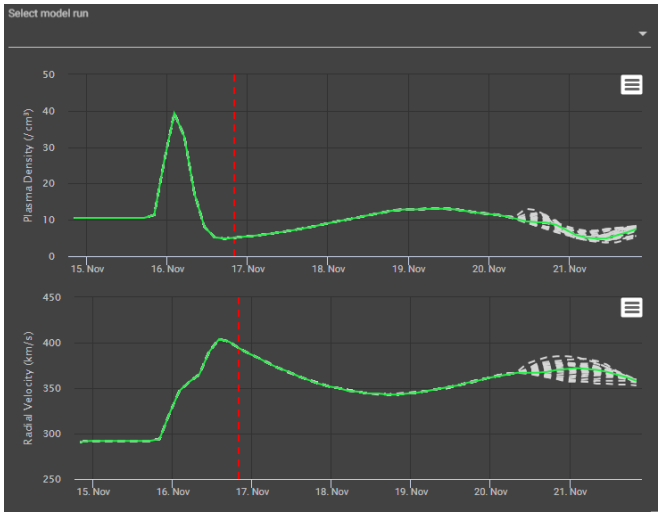
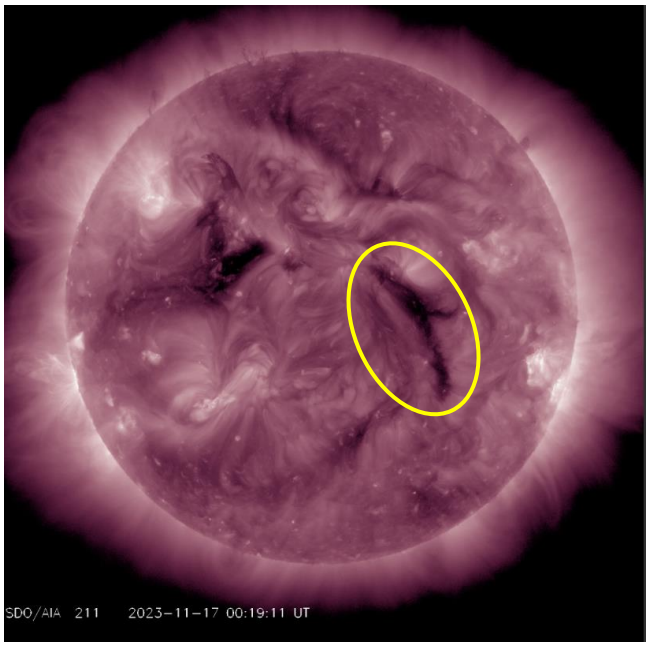


Figure 3: Latest SDO/AIA 211 image showing the new coronal hole feature.



Radio Blackouts - X-Ray Flares:

There are currently only two numbered sunspots on the visible disc. Of these AR3486 remains the largest and most complex, and is now classified as Dai/beta as the penumbra on the lead spot has become asymmetric. However, the overall area of the region's penumbra has recently diminished. AR3487 remains small, weak and relatively magnetically simple. A new region is currently rotating onto the southeast limb, and more are likely to follow through the forecast period.
Low activity has been observed over the last 24 hours, with isolated C-class flares, the largest of which a C4 peaking at 16/2022 UTC from a region that is now rotating onto the southeast limb. Activity is expected to be Low, although there is a slight chance of M-flares, this most likely from the new region on the southeast limb.

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X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	15	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy (greater then 10Mev) proton flux observed by GOES16 is currently at Background levels and expected to persist at this level. The main risk of any increase to the proton flux will be from any notable filament eruptions, however these are currently considered unlikely to reach the S1 level.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux is likely to remain at background to moderate levels today and tomorrow, increasing Moderate to possibly High levels from day 3 (19th) due to a weak high speed stream from the newly developed narrow coronal hole feature in the western hemisphere.

The associated 24-hour electron flux is expected to remain below the Active (1e8 integrated pfu) level, but with an increasing trend, which is not shown by the Met Office REFM model. However, the REFM model does show the fluence remaining below the Active threshold, which is accepted.

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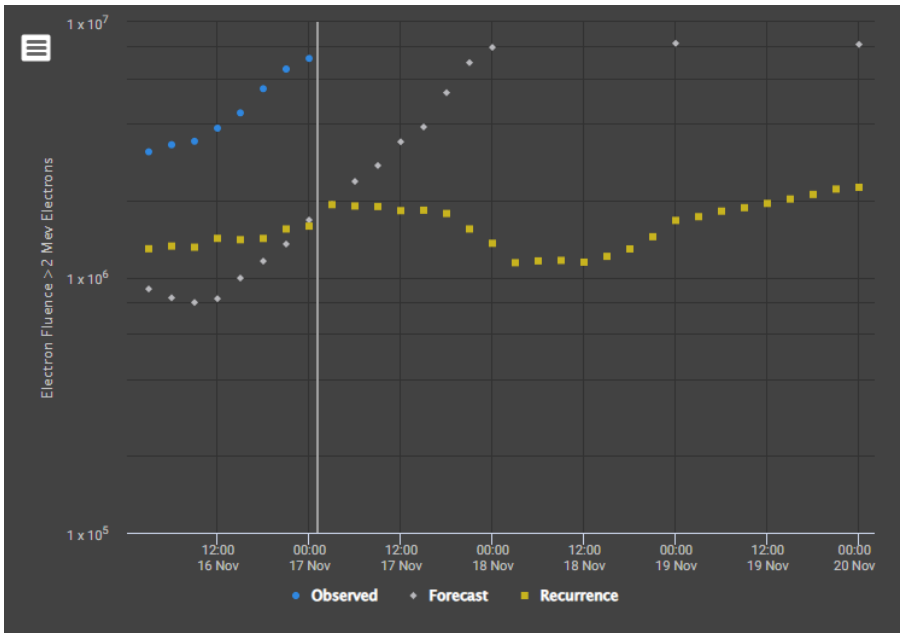
GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model.



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